

REMARKS

Reconsideration and allowance of the present application based on the following remarks are respectfully requested.

Upon entry of this Amendment, claims 1-8, 10, and 14-44 will be pending in this application. Claims 9 and 11-13 have been cancelled without prejudice or disclaimer. Claims 1, 15 and 16 have been amended. Claims 20-44 have been added.

Drawings

The drawings were objected to as failing to comply with 37 CFR 1.84(p)(5). The specification has been amended in accordance with the suggestion of the Office Action.

Therefore, the Applicants respectfully request that the objection to the drawings be withdrawn.

Claim Objections

Claims 17 and 18 were objected to under 37 C.F.R. § 1.75 (c). As discussed and agreed to during the March 7, 2002 telephone conference, claims 17 and 18 are proper multiple dependent claims. Reconsideration and withdrawal of the objection are respectfully requested.

Claim Rejection – 35 USC § 112

Claims 1-19 were rejected under 35 U.S.C. 112, second paragraph. The term “relatively inert” is defined, for example, in line 19 page 4 of the specification “The relatively inert material in particular should be resistant to oxidation...” The term “more inert” is used in comparative language “...said relatively inert material is more inert than the material...” Therefore one of ordinary skill in the art would understand the scope of the claim. The term “relatively low” such as in “relatively low index” can be understood by one of ordinary skill in the art. In addition, the term is further defined in the specification, for example, in page 15, line 4 “low-n materials” and in table 1 listing, among others, the index of various materials.

Claim 16 has been amended to recite “a semiconductor device manufactured...” The structure “semiconductor device” is understood by one of ordinary skill in the art.

Consequently, the Applicants respectfully submit that all pending claims are in full compliance with 35 USC §112, second paragraph.

Claim Rejection – 35 USC § 103

Claims 1-19 were rejected under 35 USC 103 (a) over Mori (US Pat. 6,268,904) in view of Montcalm (US Pat. 5,958,605).

The applicant respectfully traverses this rejection for at least the following reasons. The Office Action contends that Mori discloses a projection optical system comprising substantially all basic features of the instant claims. The Office Action admits, however, that Mori does not expressly disclose one of the optical elements in the illumination optical system or in the projection system such as a sensor or a lens or a reflector having a surface which is relatively coated by a relatively inert material capping layer such as diamond-like carbon, boron nitride, boron carbide, silicon nitride, silicon carbide, B, Pd, Ru, Rh, Au, MgF₂, LiF, C₂F₄, TiN, compounds and alloys. The Official action contends that Montcalm discloses an extreme ultraviolet projection apparatus having optical with a “relatively inert material” reflective capping layers.

Claim 1 recites, *inter-alia*, “at least one of said illumination system and projection system having an optical element with a surface on which radiation is incident and a capping layer covering said surface, said capping layer being formed of a relatively inert material, wherein said relatively inert material is selected from the group comprising: diamond-like carbon, Ru, Rh, B, TiN, MgF₂, LiF, C₂F₄ and compounds and alloys thereof.” Similarly, claim 15 recites, *inter-alia*, “wherein said relatively inert material is selected from the group comprising: diamond-like carbon, Ru, Rh, B, TiN, MgF₂, LiF, C₂F₄ and compounds and alloys thereof.”

The invention recited in claim 1 or claim 15 includes an inert material comprising at least one of diamond-like carbon, Ru, Rh, B, TiN, MgF₂, LiF, C₂F₄ and compounds and alloys thereof. Montcalm discloses various capping materials such as carbon, palladium, carbides, borides, nitrides and oxides. However, Montcalm is completely silent about the use of materials such as Boron (B), ruthenium (Ru), rhodium (Rh) and fluorides such as MgF₂, LiF and C₂F₄. With regard to the carbon, Montcalm uses carbon but does not disclose or suggest using diamond-like carbon (C). Consequently, neither Mori nor Montcalm disclose or suggest alone, or in combination, “at least one of said illumination system and projection system having an optical element with a surface on which radiation is incident and a capping layer covering said surface, said capping layer being formed of a relatively inert material, wherein said relatively inert material is selected from the group comprising: diamond-like carbon, Ru, Rh, B, TiN, MgF₂, LiF, C₂F₄ and compounds and alloys thereof.” Therefore,

Applicants respectfully submit that claim 1 and claim 15 are patentable and respectfully request that § 103 rejection be withdrawn.

Claims 2-10, 14 and 16-19 are dependent directly or indirectly upon patentable claim 1. Therefore, claims 2-10, 14 and 16-19 are patentable for at least the reason they contain all the limitations of claim 1. Therefore, Applicants respectfully submit that claims 2-10, 14 and 16-19 are patentable and respectfully request that the § 103 rejection be withdrawn.

New claim 20 recites, *inter-alia*, "at least one of said illumination system and projection system having a sensor with a surface on which radiation is incident and a capping layer covering said surface, said capping layer being formed of a relatively inert material." Support for the claim language may be found throughout the specification and in particular on page 4, line 15-18 where it is stated that the optical element may also be a sensor such as an image sensor or a spot sensor. In contrast, Montcalm is silent about providing an optical element having its surface covered with a capping layer and where the optical element is used as a sensor element. In fact, throughout the Montcalm patent a reference is made for making "reflective coatings" such as mirrors (see for example col. 2, lines 34-35). Consequently, none of the prior art of record disclose or suggest alone, or in combination, "at least one of said illumination system and projection system having a sensor with a surface on which radiation is incident and a capping layer covering said surface, said capping layer being formed of a relatively inert material." Therefore, Applicants respectfully submit that new claim 20 is allowable.

Claims 21-29 depend directly or indirectly from allowable claim 20. Therefore, claims 21-29 are patentable for at least the reason that claims 21-29 contain all the limitations of claim 20.

New claim 30 recites, *inter-alia*, "at least one of said illumination system and projection system having an optical element with a surface on which radiation is incident and a capping layer covering said surface, said capping layer being formed of a relatively inert material, wherein said optical element is a reflector having a multilayer reflective coating on which said capping layer is provided." Support for the claim language may be found throughout the specification and in particular in the detailed description. The reflector has a multilayer coating having only a capping layer (monolayer), as recited in claim 30. In contrast, Montcalm shows using a reflective coating having a bilayer as a capping layer. Montcalm is silent about providing an optical element having its surface covered with a monolayer capping layer. Consequently, none of the prior art of record disclose or suggest alone, or in combination, "said optical element is a reflector having a multilayer reflective

coating on which said capping layer is provided.” Therefore, Applicants respectfully submit that new claim 30 is allowable.

Claims 31-40 depend directly or indirectly from allowable claim 30. Therefore, claims 31-40 are patentable for at least the reason that claims 31-40 contain all the limitations of claim 30.

New claim 41 recites, *inter-alia*, “said capping layer comprises a first sub-layer of said first material; a second sub-layer of a third material having a refractive index at said wavelength higher than said first material and being more inert than said second material; and a third sub-layer formed of a fourth material that is relatively inert, said first, second and third sub-layers being provided in that order with said third sub-layer outermost.” Support for the claim language may be found throughout the specification and in particular in the detailed description. The capping layer, as recited in claim 41, has a multilayer (trilayer) structure. In contrast, Montcalm shows using a reflective coating having a bilayer as a capping layer. Montcalm is silent about providing a capping layer with a trilayer structure. Consequently, none of the prior art of record disclose or suggest alone, or in combination the subject matter recited in claim 41. Therefore, Applicants respectfully submit that new claim 41 is allowable.

Claims 41-44 depend directly or indirectly from allowable claim 41. Therefore, claims 41-44 are patentable for at least the reason that claims 41-44 contain all the limitations of claim 41.

CONCLUSION

In view of the foregoing, the claims are now in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, he is kindly requested to contact the undersigned at the telephone number listed below.

Attached is a marked-up version of the changes made to the specification and claims by the current amendment. The attached Appendix is captioned **"Version with markings to show changes made"**.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

Pillsbury Winthrop LLP

By: 

John P. Darling

Reg. No. 44,482

Tel. No.: (703) 905-2045

Fax No.: (703) 905-2500

JSB/JPD/KG
1600 Tysons Boulevard
McLean, Virginia 22102

Enclosures: Appendix

APPENDIX: VERSION WITH MARKINGS TO SHOW CHANGES MADE

Please delete the paragraph starting with line 6, page 8 and insert new paragraph:

-- The beam PB subsequently impinges upon the mask MA which is held in a mask holder on a mask table MT. Having been selectively reflected by the mask MA, the beam PB passes through the lens PL, which focuses the beam PB onto a target area C of the substrate W. With the aid of first positioning means PW and the interferometric displacement measuring means IF, the substrate table WT can be moved accurately, e.g. so as to position different target areas C in the path of the beam PB. Similarly, the positioning means PM can be used to accurately position the mask MA with respect to the path of the beam PB, e.g. after mechanical retrieval of the mask MA from a mask library. The references M1, M2 correspond to reticle alignment marks and the references P1 and P2 correspond to wafer alignment marks. In general, movement of the object tables MT, WT will be realized with the aid of a long stroke module ([course] coarse positioning) and a short stroke module (fine positioning), which are not explicitly depicted in Figure 1. --

IN THE CLAIMS

The claims have been amended as shown below:

1. (Twice Amended) A lithographic projection apparatus, comprising:
 - an illumination system constructed and arranged to supply a projection beam of radiation;
 - a first object table provided with a first object holder constructed and arranged to hold a mask;
 - a second object table provided with a second object holder constructed and arranged to hold a substrate;
 - a projection system constructed and arranged to utilize said radiation to image an irradiated portion of the mask onto a target portion of the substrate; and
 - at least one of said illumination system and projection system having an optical element with a surface on which radiation is incident and a capping layer covering said surface, said capping layer being formed of a relatively inert material[.],

wherein said relatively inert material is selected from the group comprising: diamond-like carbon, Ru, Rh, B, TiN, MgF₂, LiF, C₂F₄ and compounds and alloys thereof.

15. (Twice Amended) A device manufacturing method using a lithographic apparatus, the method comprising:

providing a mask containing a pattern to a first object table;

providing a substrate at least partially covered by a layer of energy-sensitive material to a second object table; and

irradiating said mask and imaging irradiated portions of said pattern onto said substrate;

said irradiating comprising [reflecting] directing radiation [off of] onto a surface of an optical element, the surface having a capping layer formed of a relatively inert material,

wherein said relatively inert material is selected from the group comprising: diamond-like carbon, Ru, Rh, B, TiN, MgF₂, LiF, C₂F₄ and compounds and alloys thereof.

16. (Amended) A semiconductor device manufactured in accordance with the method of claim 15.

End of Appendix